by adding water equal to from 15 to 30% of the total water provided by the meat and food materials.

For the purpose of controlling and reducing the temperature of the mixture, part or all of the water may be added in the form of crushed ice. This has the advantage of maintaining a desirable low temperature in the mixing step. This procedure is not essential, however, since other means of cooling and refrigeration can be employed.

It will be understood that the ingredients should be combined and mixed sufficiently to achieve a relatively uniform distribution. The uniformity of the mixture may be further improved by subjecting the mixture to a grinding or size reduction step. Where this is to be employed, the meat particles will initially be added in a larger size than that finally desired. Any of the standard methods of grinding meat mixtures can be used. The secondary grinding step, while desirable, can be omitted where all ingredients have been reduced to a proper size before the mixture is formed.

As the next step, the mixture is held under refrigeration but at a non-freezing temperature until the non-meat food material has at least partially rehydrated. For example, the meat mixture may be held and tempered for ½ hour to 8 hours at a temperature ranging from 30 to 50° F. Preferably, sufficient water has been added so that the non-meat ingredients can become substantially saturated with water while still leaving a substantially continuous phase of free water in the mixture.

After the dry components of the mixture have at least partially rehydrated, the mixture is subjected to evaporative freezing. The reason for incorporating excess water over that required for the rehydration is so that the particles of meat and food material at the start of the evaporative freezing step will be coated with unabsorbed water. The water layer on the exterior surfaces of the particles will evaporate first, causing the meat mixture to become chilled and frozen before any substantial amount of the bound water within the particles has evaporated. The presence of free water at the start of the evaporative freezing step tends to protect the particles against surface changes which might occur before the particles are frozen. The evaporative freezing rate will be extremely rapid, with resulting benefits to the quality of the product as described above.

Since the meat mixture at the start of the evaporative freezing step is in a soft, watery condition, the initial evolution of air and water vapor may cause the mixture to froth and expand in volume unless the mixture is confined between plates. For some purposes, the frothing and expansion might be considered undesirable, but it has been found to be beneficial in preparing meat mixes according to the present invention. It is, therefore, contemplated that the method of the present invention will permit the meat mixture to expand in volume during the evaporative freezing step and then to become frozen in expanded condition. The increase in volume may range from 25 to 125%, depending on how rapidly the vacuum is applied. Preferably, the expansion should be at least 50%, and good results have been obtained with an expansion of up to 100%. The expanded condition of the product permits a more rapid removal of the frozen water by sublimation, and results in a porous, open-type product which rehydrates readily and uniformly.

In other words, the method of this invention contemplates the step of freezing a meat mix containing a mass of comminuted meat and also containing unabsorbed water in addition to the water naturally present in the meat by an evaporative freezing procedure wherein the freezing step is conducted in the absence of mechanical restraint on the volume of the meat mix during the freezing whereby the volume of the frozen mass is greater than the unfrozen mass from which it is obtained. As pointed out previously, the meat mix should be free to expand during the evaporative freezing step, and should not be confined between plates or otherwise subjected to mechanical restraint which would tend to maintain its original volume.

After the meat mix has been frozen in expanded condition through evaporative cooling, it is subjected to the usual freeze drying procedure wherein the remaining water is removed by sublimation. After the moisture content has been reduced to below 5% and preferably below 2%, the product is ready for packaging and commercial distribution. The dried product can be broken up to facilitate handling and packaging. For example, it can be shredded or ground, being easily broken up in the dry state. It is not necessary to have all of the particles of the product of similar size, and the product may be in the form of irregular-sized granules containing both meat and non-meat materials.

When it is desired to prepare the meat mix for cooking, all that is required is to add water sufficient to rehydrate the materials. For example, from ½ to 1½ parts by weight of water should be added per part of a dehydrated meat mix. For most formulations, approximately equal parts by weight of the meat mix and water can be used. It is desirable to avoid excess water in preparing the meat mix for cooking, since the evaporation of the excess water will increase the required cooking time. The meat loaf will then be cooked in the regular way, or used to prepare other food products such as meatballs, spaghetti sauce, etc.

If desired, other ingredients, such as fresh eggs, whole milk, canned tomatoes, and the like, may be combined with the meat mix. These other ingredients may be added at the same time as the water for rehydration.

No special equipment is required for practicing this invention. Standard mixing equipment may be used for combining the fresh meat, water, and partially dehydrated food materials. The holding or tempering step may be carried out in refrigerated storage rooms, the meat mix being contained in shallow trays, which can be loaded into the vacuum drying equipment. Freeze drying equipment of a heated plate type can be used quite satisfactorily. In accordance with known practice, the trays containing the material for evaporative freezing and dehydration are placed on the plates within the drying chamber, and the unit is sealed. A high vacuum is then applied, which may be created by steam ejectors, or similar equipment. For example, the pressure may be reduced to 2 mm. Hg downward to approximately .3 to .5 mm. Hg. As soon as the product has become frozen, the circulation of heating fluid to the plates is started, and the freeze drying operation is carried out in the usual way.

The method of this invention is further illustrated by the following specific examples:

Example 1

A chicken loaf was prepared by mixing together the following ingredients, which included fresh and partially dehydrated ingredients:

9 lbs. chicken (ground through ⅜" and 3/16" opening)
135 gm. minced onions (air-dry, raw)
960 gm. eggs (fresh)
180 gm. margarine
135 gm. celery (air-dry stalk granules)
199.2 gm. seasoning
540 gm. bread (non-seasoned fine crumbs)

The fresh and partially dehydrated ingredients were mixed with a little water and blended, and then the other ingredients were added. Cold water was then added to this mixture at a rate of 1½ lbs. of water to 8 lbs. of mix. The total water added was estimated to equal about 35% of the water already contained in the meat and food material. After further mixing, the product was spread on trays and freeze-dehydrated, using the evaporative freezing technique.

In the initial stage, the pressure was reduced to 105